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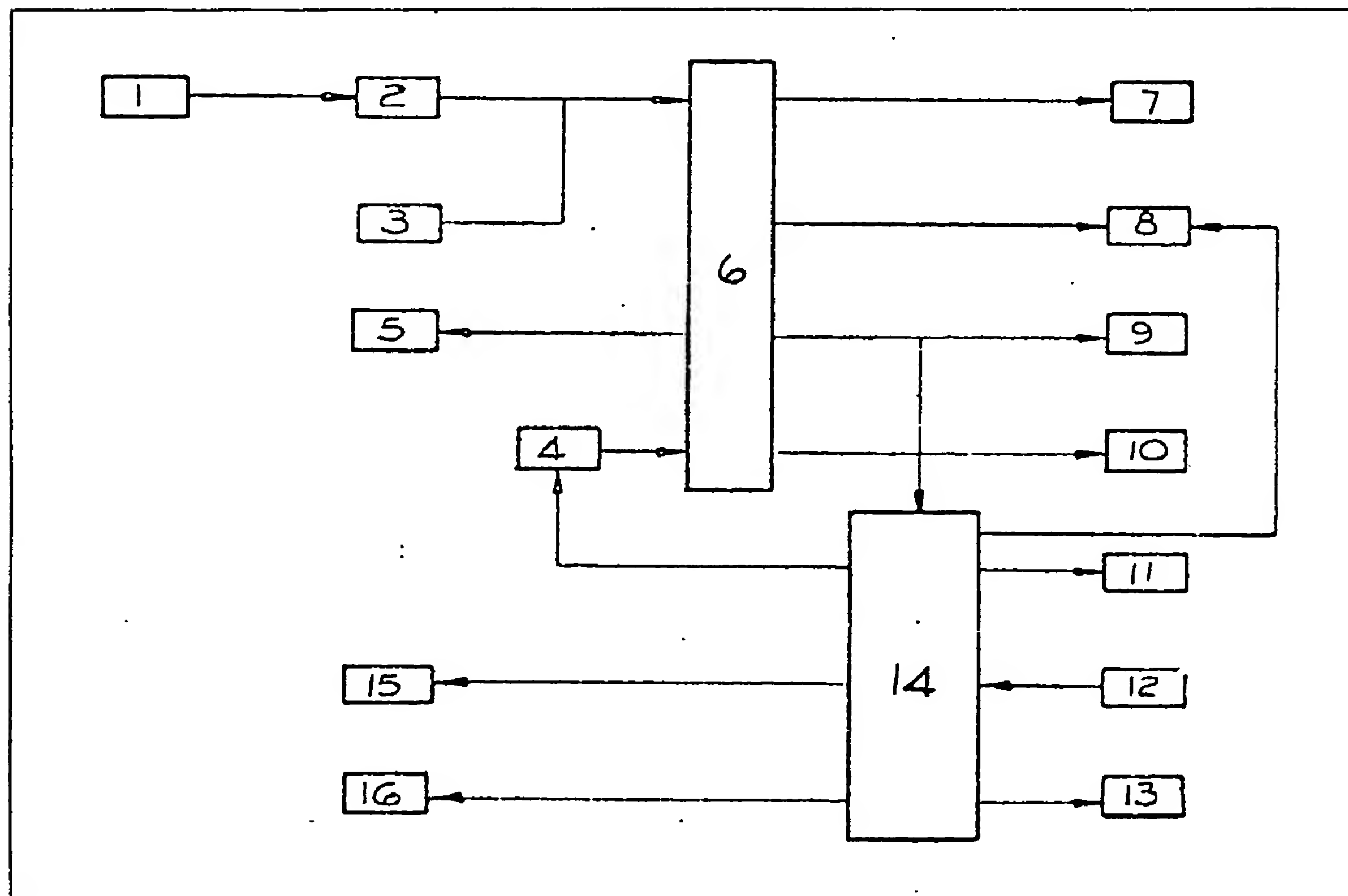
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(54) Apparatus for controlling a tablet
press

(57) Apparatus for controlling a tablet

press comprises units (11-16) shown.

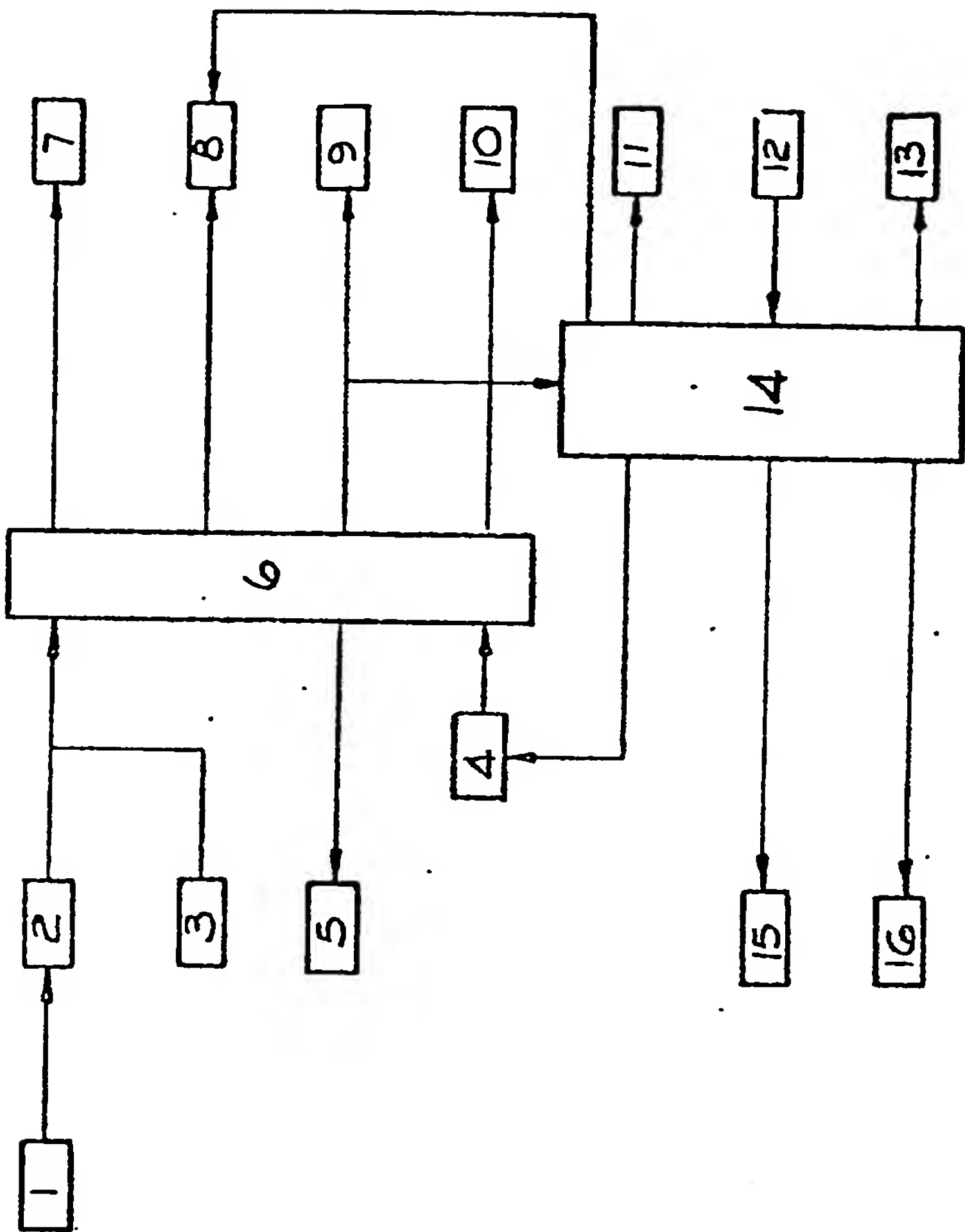
A balance (12), fed with single tablets from the compressing machine *via* a sampling mechanism (11), is interfaced with an electronic computer (14) programmed according to the product required, to handle this weight data and subject it to acceptance checks. Repeated samples of single tablets are intercepted by the tablet sample mechanism (11) and guided to the balance (12) and when sufficient samples have been weighed action is taken to either accept or reject (13) all tablets made during the sampling period. At the end of each sampling period, if significant error is detected, a correction signal is output from the computer (14) to adjust the amount of material loaded into the dies of the press. Elements (1-10) relate to a known system for keeping compaction force constant; the weight error of (11-16) adjusts the reference value for the compaction control system (1-10).



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SPECIFICATION

Apparatus for controlling a tablet press

5 This invention relates to apparatus used for the automatic on-line monitoring and controlling of high speed tablet machines or pelleting presses where the end product formed by a compression process has to be maintained to close weight tolerances, but
10 which have an operating speed beyond the speed at which conventional weighing equipment can operate.

The term tablet as used herein includes all products manufactured from powdered or granulated
15 material formed in a die by the application of pressure from opposing punches and includes medicinal tablets, compressed confectionery, catalyst pellets, powder metal components, ceramic products and paint products.

20 The manufacture of tablets by this method is well known and high speed machinery for carrying out their manufacture at speeds in excess of 10,000 tablets per minute is also well known. The operating principle is that a plurality of dies mounted in a
25 rotating die table pass under a filling device. The weight of the tablet or product depends on the volumetric fill present in the die when it is filled with powder or granulate. The free volume of the die and, therefore, the tablet weight is controlled by the
30 position of the lower punch which extends into the die from below. To fill the die completely during the rapid rotation of the die plate the lower punch after ejecting the tablet passes under the filling device. The descending lower punch controlled by a lower-
35 ing cam sucks the powder into the die to give an overfill condition by going to a level lower than is necessary to satisfy the weight volume relationship of the tablet, then just prior to the lower punch passing under the rear end of the filling device the
40 excess material is pushed back into the filling device and a scraper blade flush with the die table levels off the powder remaining in the die as the lower punch traverses over an adjustable metering cam. The weight is therefore controlled by the free volume
45 which, in turn, is controlled by the height setting of the metering cam.

The formation of the tablet is completed as the upper and lower punches pass between rolls which apply pressure to the powder or granulate.

50 It is important in the pharmaceutical industry to maintain a very close weight tolerance to ensure that each tablet contains a predetermined amount of active ingredient and in the case of most products these tests have to comply with British, European, or
55 U.S. Pharmacopoeia Specifications.

In order to compensate for variations in granulation, regular weight checks are required followed by compensating adjustments of the metering cam if necessary. On high speed machines the problem is
60 more acute and more frequent weight checks are required or a substantial number of tablets may be rejected.

As the die bore and punch length tolerances are held to very close tolerances, an assumption can be
65 made that if the weight of powder remains constant

then the force to compress that powder will also remain constant.

One feature of embodiments of the present invention is based on this principle and covered by British
70 Patent No. 1,152,061 held by The Upjohn Company of the United States of America and sub-licensed to Manesty Machines Limited. This patent discloses control of a tablet machine comprising continuous monitoring of compaction forces developed during
75 the compaction process. By using a strain gauge mounted on a force receiving component there is measured a force proportional to the magnitude of the force imposed on the tablet, so that every tablet can be monitored and the signal compared with a
80 preset reference. Any variation from the reference signal produces a comparison signal for use in a control loop with feedback to the motorised metering cam to maintain the average signal within limits and maintain constant compaction force. Accepting
85 that "Average Tablet Weight" on a given tablet machine is related to "Average Compaction Force" then by maintaining the average compaction force constant, the average tablet weight is also maintained constant.

90 It is also known that the relationship between average tablet weight and average compaction force, although invariably valid over the short term, can lead to occasional adjustments of controls being required after prolonged operation. Also the tight-
95 ness of the punch in the guide caused by the ingress of fine powder can also influence the force/weight relationship.

According to a second feature of embodiments of the present invention, there is provided apparatus
100 which, with the apparatus already mentioned, involves the removal of tablets from identified stations of the compressing machine for weighing of these tablets on an individual basis with an electronic balance.

105 The results of the weighings are subjected to programmable acceptance checks within a computer, and depending on the outcome, all tablets produced during these checks which are stored in a pending bin will be automatically accepted or re-
110 jected at the termination of each programme of checks.

In addition, apparatus according to the present invention may offer "on-going" monitoring of the process by means of a Video Display Unit and is
115 backed up by a printer mechanism producing hard copy of results for "on line" Quality Control.

In addition, apparatus according to the present invention complements the first mentioned apparatus such that any variations of the relationship
120 between average compaction force and average tablet weight are taken care of by overall feedback to the first mentioned apparatus based on actual average tablet weights.

The total system therefore incorporates the advantage of a fast acting compaction force based weight control system monitored by an accurate but relatively slow weight control system.

The present invention is apparatus for controlling a tablet press which has a plurality of dies and a
130 control mechanism for adjusting the volume of

material loaded into each die of the press, the apparatus comprising means for collecting samples of the tablets produced in a sampling period, means for weighing the samples, comparison means for
 5 comparing the weight of the samples with predetermined data and consequentially accepting or rejecting the tablets produced in the sampling period, and means responsive to the comparison means for adjusting the control mechanism to compensate for
 10 any significant error in the weight of the samples.

An embodiment of the present invention will now be described, by way of example, with reference to the accompanying drawing, the single figure of which is an information flow diagram illustrating a
 15 control method according to the invention.

A compaction force transducer 1 supplies compaction force data to signal processor 2 which drives a compaction force indicator 3 and a comparator 6. The comparator 6 acts on the difference between
 20 compaction force data and force control references 4, and drives an adjustable tablet weight metering cam 7 to complete a weight control system based on compaction force measurement.

The comparator 6 also drives a totaliser 5, stop
 25 machine control 8, tablet reject mechanism 9 and reject station identification 10, all of which are well known functions and are part of the compaction force based weight control system.

The accurate weight control apparatus comprises
 30 units 11-16. A balance 12, fed with single tablets from the compressing machine *via* a sampling mechanism 11, is interfaced with an electronic computer 14 programmed according to the product required, to handle this weight data and subject it to
 35 acceptance checks. Repeated samples of single tablets are intercepted by the tablet sample mechanism 11 and guided to the balance 12 and when sufficient samples have been weighed action is taken to either accept or reject 13 all tablets made
 40 during the sampling period.

A video display unit 15 gives on-going monitoring of the process and a printer 16 produces hard copy documentation.

At the end of each sampling period, when the
 45 tablet weight accuracy has been determined by the computer programme, any significant error causes a correction signal to be output from the computer 14 to the compaction force based weight control system. The correction signal causes the tablet weight
 50 metering cam 7 to operate in such a manner as to reduce the measured weight error. The correction signal modifies the force control references 4 in such a manner as to reduce the measured weight error. The correction signal causes the compaction force
 55 indication to become some new value and the resultant deviation from the initial value is indicated.

CLAIMS

60 1. Apparatus for controlling a tablet press which has a plurality of dies and a control mechanism for adjusting the volume of material loaded into each die of the press, the apparatus comprising means for collecting samples of the tablets produced in a
 65 sampling period, means for weighing the samples,

comparison means for comparing the weight of the samples with predetermined data and consequentially accepting or rejecting the tablets produced in the sampling period, and means responsive to the
 70 comparison means for adjusting the control mechanism to compensate for any significant error in the weight of the samples.

2. Apparatus as claimed in claim 1, in which the comparison means comprises a computer.

75 3. Apparatus as claimed in claim 1 or claim 2, in which the sample tablets are weighed individually, a sampling period being terminated when a sufficient number of tablets have been weighed.

80 4. Apparatus for controlling a tablet press substantially as hereinbefore described with reference to, and as shown in, the accompanying drawing.

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